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ABSTRACT

Designed to promote the interchange of information and services among the people of the region, the Eastern Caribbean Center Telecommunications Project Network (ECCTP) utilizes a network of both audio and computer-linked nodes connected by telephone lines to deliver instruction to remote sites. This network has been used by ECCTP to conduct experiments in long-distance teaching from the spring of 1986 to the present. Although most of these experimental classes have consisted of computer-oriented content, such as elementary BASIC programming, classes have also been taught in biology, English, and remedial mathematics. Classes are taught simultaneously at a home site and at a distant site, e.g., a class being presented by an instructor in a classroom on the St. Croix campus of the University of the Virgin Islands is transmitted to a classroom on the St. Thomas campus, and students at both sites participate in the class. A series of four pilot tests encountered various technical problems and identified a need for more careful pre-instructional planning than traditional classroom teaching. Areas that must be considered in planning for the actual provision of instruction include the relationship of teaching to the instructional objectives, the motivation of students, the monitoring of student learning, managing classroom activities, modeling, and technical capabilities. After the class has been taught, post-instruction evaluation must also be addressed. (EW)

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Pedagogical Considerations for the Eastern Caribbean Center Telecommunications Project

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Paper presented at the annual meeting of the
American Educational Research Association
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PEDAGOGICAL CONSIDERATIONS FOR THE EASTERN CARIBBEAN CENTER TELECOMMUNICATIONS PROJECT

by
Rodney Clarken, Alan Lewit and Lynn Rosenthal

Educational telecommunication networks are changing the way people learn and the opportunities to learn for people throughout the world. The Caribbean region has not yet entered the information age to the extent that any appreciable number of people have been affected. The University of the West Indies Distance Teaching Experiment (UWIDITE) is the most notable example of the beginning efforts made in distance teaching in the Caribbean, but more must be done.

The potential social, economic, and educational benefits for the Caribbean from using telecommunications are unlimited. The technology is presently available to link the islands of the West Indies together in an network for the benefit of all. The Eastern Caribbean Center (ECC), a program funded by the Department of Interior to promote the interchange of information and services among the people of the Eastern Caribbean, is becoming the most logical institution for carrying out this important task. The Eastern Caribbean Center Telecommunications Project (EECTP) focuses on establishing a cost-effective medium to facilitate ECC goals and is the first step by the ECC toward uniting the various islands, countries, and peoples of this region through telecommunications for their social, economic, and educational development.

Telecommunications Media

Education may be delivered using telecommunications to remote sites either through one-way, two-way, or multiple interaction of the participants. The transmission of this instruction may be through audio and/or visual media.

Audio transmission is usually accomplished through telephone, radio, micro-wave, and/or satellite signals. Telephone lines are usually used for two-way audio connections. If more than two sites are to be connected, then some sort of bridging network becomes necessary. One-way radio broadcasts can reach large audiences at a relatively small cost, but this approach does not provide the interaction which play a vital role in effective teaching.

Visual images can be transmitted by TV broadcast, slow scan (freeze frame) TV using telephone circuits, or by computer interpretation of data transmitted by telephone, radio, or television. Of these mechanisms, only television broadcast can carry live moving images of people. Slow scan offers the ability to transmit static images over telephone circuits, but usually requires approximately 10 to 35

seconds for image transmission and employs relatively expensive equipment. Computers allow production of static and moving images on relatively inexpensive equipment.

Computers can be used live or asynchronously in distant learning. Electronic mail and bulletin boards are excellent and innovative uses for asynchronous instruction and are presently being widely used. Live distant instruction is very rare and usually limited to text. The telewrite system supports transmission of visual images created by a computer or by a video camera, an the use of a graphics tablet for real time pointing or sketching. This approach is an improvement over specialized slow scan equipment, but does not support simultaneous execution of programs at all sites and hence, does not fully exploit the power of the computer.

Eastern Caribbean Telecommunications Project Network

The ECCTP presently utilizes a network consisting of both audio and computer-linked nodes connected by telephone lines. The advantages of using telephone connections are the initial low cost and widespread general availabilty of the equipment and services. The disadvantages of telephones in distance teaching is the high cost of international calls, the necessity of using bridging services if more than two sites are used, the inferior quality of some connections, and the unavailability of lines, especially in the Caribbean regions with limited local distribution systems.

Audio transmissions utilize Darome conference phones. These conference phones use a series of push-to-talk microphones distributed among the conference participants to address the remote sites and a speaker at each site to amplify the incoming voices.

The computer-link consists of Apple IIe or Apple IIgs computers linked through modems to each other by special telecommunications software developed by the ECCTP and displayed on large screen and/or regular monitors at all sites.

The computer linkage supports two modes of operation: transmission of a cursor position controlled by a "mouse" for pointing or sketching, and simultaneous execution of programs by transmission of all keyboard input. The second mode allows the simultaneous display of images which have been pre-stored at all sites or which are simultaneously generated at all sites. A key advantage to this approach is the ability to run a wide range of instructional support software with the only restriction being that programs must use the standard operating system interface for keyboard input. Examples of this mode of operation include use of specialized programs to create static or animated pictorial material. With the increasing availability of low cost

video input systems for microcomputers, future development of the system will support slow scan transmissions, real time sketching and pointing, as well as the linked simultaneous generation of images/text, giving a single, integrated work station for distant learning which allows all forms of visual image creation.

The network can be used to deliver instruction in a variety of formats. A formal course or program might originate from a particular educational institution and be accredited by that institution. Less formal cooperative efforts might be instituted to provide tutoring or workshops in basic skills or particular technical areas. The network might be the sole medium of instruction, or might be part of wider programs involving site visits, broadcast, correspondence, etc. Reference materials might be transmitted over the network, mailed as documents or microfilm, or be made available through video disk technology. Effort must be made in specification, planning and design to insure that optimal delivery mediums are selected for each area of instruction, and that adequate supporting resources are made available.

ECCTP Experiments

With this network, the ECCTP has conducted experiments in long-distance teaching from the spring of 1986 to the present. Although most of these experimental classes consisted of computer-oriented content, such as elementary BASIC programming, there were various classes taught in biology, English, and remedial mathematics. Classes have been taught from St. Croix to St. Thomas, St. Kitts, and Anguilla, from Kingston to St. Croix, from San Juan to St. Croix and St. Thomas, and from St. Thomas to St. Croix.

Initially, there were four one-hour class sessions using the network offered free to volunteers on the UVI campuses of St. Thomas and St. Croix. The original plan was to have a three-way transmission between St. Thomas, St. Croix and St. Kitts, but because of transmission difficulties, St. Kitts could not be included.

There were many problems associated with the transmission of information in the original field tests of the equipment. There were many difficulties and delays as a result of transmission problems. The conference telephone connections were not suitable and often required the instructor to restate what had been said and to speak directly into the conference telephone microphone, which limited the instructors mobility and ability to face the homesite class. As there was only one microphone for everyone to use, student input was somewhat hampered. Many technical problems relating to the software and transmission of the signal were encountered and required people familiar

with the system to de-bug and reconnect. Much instructional time was lost because of these problems, but many of them have been resolved and others are presently being addressed. In response to the transmission problems, radio is very seriously being considered as an alternate to the telephone. Radio is a very elegant alternative to using the telephone. The ECCTP participants would not need to use an audio bridge service, would have a modest capital investment that would overcome problems of telephone connection availability and quality, and would offer continuous multi-channel support without additional operating costs.

Coordination between the sites was also a problem in the beginning. If one site had some problem, both sites had to wait until it could be resolved. All materials had to be distributed to the sites far enough in advance so that everyone had them available. If all sites did not have the proper software, if that software or hardware was not working, if the lines were not transmitting properly, or if one class was not ready then the instruction was halted. Each of these problems were encountered in the initial four class experimental test of the network, but have created only very minor problems in the present use of the network. The University of the Virgin Islands (UVI) is presently offering a two credit course for its students in BASIC programming using the telecommunications system. The students are being periodically assessed at both the St. Thomas and St. Croix campuses to determine if there is any significant difference between the performance of the students at the remote and home sites. These experiences have demonstrated that a period of development and establishment of facilities must be expected, before routine use of systems for remote instruction is possible.

Instruction and the Media

There are several limitations and considerations to understand when using audio and computer telecommunications for instruction.

The first problem to be overcome is the establishing of communications with the remote site. A training manual and a short training course are presently being developed to help instructors with the physical components of the system. With a little experience, instructors should feel comfortable working with the hardware.

Once instructors have overcome the technical problems that may be associated with establishing communications with the distant site, they should experience little technical difficulty using the media.

The audio aspects of the media are straight forward and differ little from good pedagogical practice in the traditional classroom. Some adjustments may be required for

the instructor. He should direct his comments toward the microphone so that students at the remote site can properly hear him. Some experimenting may be needed to determine the best placement of the microphones. We have found that when the microphone is placed too closed to the computer that the noise from the computer is picked up by the microphone. Lapel or lavaliere microphones that can be wore by the instructor should help to correct this problem. The students will need instruction and some reinforcement to press the button to activate their microphones and to speak clearly into their microphones. This is especially true for students at the home site as they can address the instructor without using the microphone, which results in the students at the remote site not being able to hear the question or comment of the student. Use of room mikes controlled by the instructor at the home site and a course facilitator at remote sites is planned, and this approach should allow a more natural format of audio interaction initiated by a student raising his hand or perception of questions by the instructor or facilitator. Voice modulation and tone are not lost using this media.

The main limitation and consideration when using the computer for distant teaching is the lack of visual cues between the instructor the class and the necessity of adapting more traditional visual media to the computer. The lack of instructor-student visual cues can be somewhat compensated for by utilizing more oral cues through such techniques as increased and better questioning.

Computers offer a powerful medium for the visual display of text, data, graphs, drawings, and pictorial images. These visuals can be easily changed and can be used in interactive learning situations through such things as pointers, games, simulations, and other innovative techniques. The computer can do the same things that can be done on a chalkboard, overhead projector, and other media that display text, data, and other visuals.

The computer-link component lends itself well to the teaching of programming lectures and computer-oriented subjects, such as word-processing, spreadsheet and data-base instruction. With programming lessons, the instructor produces the program on all computer nodes, asking all classes to contribute to the development of the program. All nodes have the same ability to control the network as the instructor's node, so students at the remote sites can respond in the same manner as the instructor does.

Pre-instructional Considerations

The preparation or pre-instructional phase of distance teaching using the ECC computer network requires more planning, effort, and time than traditional classroom

teaching to be effective. This extra effort results partly from the use of a new medium, and partly from raised student expectations when advanced technology is employed.

Planning

Most instructors can lecture and use the chalkboard without much difficulty. Often the material is presented spontaneously, and these mediums allow for this spontaneity. These methods will need to be adapted to teaching material using audio and computer transmission of the instruction. While the latest versions of the ECCTP system allow the same real time transmission of writing and sketching, student expectations of quality in visual displays are influenced by association with broadcast television, and use of prepared material is more effective. Not only must the lesson be better planned, it must also be planned differently if it is to be as effective as face-to-face teaching. For instance, materials must be prepared far enough ahead of time so that they may be distributed to all the students at all sites. This preparation calls for the instructor to foresee the questions and learning needs of the students, so that he will not need to resort to the chalkboard or some other material he may have available to reinforce his concepts and answer the questions of the distance-site class. The materials should be presented in such a way as to limit confusion and increase understanding.

The instructor must plan the lesson to be given without the use of visual aids and cues that might be taken for granted in face-to-face teaching.

Pre-assessment. As much as practical, the instructor should try to ascertain what skills and knowledge the students have before instruction, so that the material is neither too difficult, nor too easy. A pre-assessment of the students will enable the instructor to better plan appropriate learning experiences for the students and have a better measure of how much the students learned as a result of the class. Generally, a pre-assessment cannot be carried out before the class begins, but could be done the first or second class meeting.

Setting Objectives. The most important part of planning is establishing clear objectives for the students and creating activities that will lead to the fulfillment of those objectives. Objectives should ideally be stated as much as possible in terms of measurable behavior. The objectives will be based on the overall goals for the course and should be written in terms of what the students will do, not what the instructor will do. The objective should clearly state the behavior expected, under what conditions that behavior is expected, and the standard or level of accomplishment expected for completion of the objective.

These elements can be remembered more easily by using the acronym of ABCD, where A is for audience, B is for behavior, C is for condition, and D is for degree of accomplishment.

Lesson Planning. The heart of the preparational phase of teaching is the actual planning of the activities designed to assist the students to accomplish the goals and objectives. Several factors should be kept in mind when preparing these activities. As the human factor is reduced because of the use of technology, other motivational and instructional aids should be increased. Reinforcement of behavior, pacing, monitoring, interest, and feedback can all be adjusted to increase the motivation and the design of learning materials can be made more interesting and explanatory.

Evaluation. It is helpful to establish the evaluation instruments and procedures at this time so that your evaluation will be tied directly to your objectives and learning activities. By establishing objectives, activities, and evaluation at the same time, you will be better able to evaluate what you are intending to teach.

Briefly stated, the instructor needs to have an idea of where the students are at, where he wants them to go, how he can best get them there, and how to know when and to what extent they have arrived.

Effort and Time

The amount of effort and time required to plan an effective lesson for distance teaching using the ECCTP computer network is increased. Some courses, such as computer science courses that use the computer for class demonstration of learning objective and concepts, can be taught with little adjustment, but other courses, such as psychology or science, will require major changes to make them effective.

Bearing the above in mind, the instructors should adequately prepare and the administration should adequately reward instructors for distance teaching, as poorly planned lessons will result in poor classes and a low evaluation of the telecommunications network.

Instruction

Understanding the limitations and constraints of distance teaching using audio and computer transmission, can help the instructor overcome some problems that will limit the effectiveness of the lesson. Because the student and instructors are so accustomed to face-to-face instruction, some adjustment will have to be made to adapt to the use of telecommunications. Some areas that should be addressed are teaching to an objective, maintaining student interest,

monitoring learning, classroom management, modeling the concepts, technical limitations, and instructional skills.

Teaching to the Objective

Just as setting good objectives is the most important part of the pre-instructional phase of the lesson, teaching to the objective is the most important part of the instructional phase of the lesson. Doing a task analysis of the objective - breaking it down into its component parts - will help the instructor to teach the lesson in a way that the students will be able to understand. If prerequisite skills are missing, the students may not be able to benefit from the instruction. If steps are omitted in the learning sequence, then much time may be wasted and little learning result. If the lesson is focused on the objective, then time will not be wasted on extraneous or irrelevant material. It is helpful to share your objective with the class so that they know where you are trying to go with the lesson. Maybe they can help you get there.

Motivating

Motivating students is a difficult task when there is face-to-face interaction, but more difficult when the physical presence is removed. The less intrinsically motivated the students are to learn the material, the more extrinsic motivation needs to be used in its place. The physical presence of an instructor is an extrinsic motivator that will be absent at the remote site. Therefore, the instructor needs to make his presence felt in other ways. One of the most effective ways is to actively involve the students in the learning process through interaction.

By frequent questioning, the students are required to be engaged in the learning process. These questions should usually be directed to individuals, not to the class in general. The instructor should first ask the question of the entire class, give them a moment to think about it, and then call on an individual. If practical, each individual should be called upon each class period, but if not the opportunities to respond should be distributed equally, not given disproportionately to the brighter students as is done in most classrooms. This form of questioning was used effectively in the pilot project to involve all students in the class, especially the students at the remote site because they can more easily become disengaged. At the beginning of the class, each student was asked to introduce himself to the people in the other site. These names were written on the monitor and the instructor made a point to call on each person using that list. Questioning enables the instructor to give feedback on learning and positive

reinforcement, both important motivators. It also increases the level of engagement in the students and their possibility for success.

Monitoring

In the traditional classroom, the monitoring of student learning and understanding is often done using visual cues, such as students raising a hand or using body language to let the instructor know when they do not understand something or are trying to communicate something to the instructor. These visual cues, which are often taken for granted and unconscious, are absent using the computer and audio transmissions. Therefore, one must compensate for the lack of visual cues by using more audio interaction and maybe some signal to indicate there is a question or comment. The course facilitator can be very helpful in this regard as he can see the students at the remote site and can alert the instructor if he perceives any problems.

Asking frequent questions and directing the questions to different students in the class lets the instructor know how much of the material the students are grasping and where there may need to be further instruction. Frequent assignments, exercises, and other evaluative methods can also be employed to better monitor class learning. Allow the students to practice the concepts in class to see that they understand them, and then give them assignments that require further practice and development of those concepts outside class. Giving pre- and post-assessments will help you to better determine how much the students have learned and are grasping the course content. It also has the added benefit of increasing student motivation. Formative evaluations should be conducted throughout the course.

Managing

Managing classroom activities at the remote site can be a major problem. Without the directive influence of an instructor in the classroom, there is no assurance that students are paying attention, behaving, following the lesson, or even present, unless some special attempt is made to engage the students to monitor the learning. Facilitators will be necessary at remote sites if the students are not mature and self-disciplined. Another consideration is the managing of the students work and assignments. The students will not have direct access to the instructor in class or after class. This limitation will require some support for outside assistance for students and a means for written assignments between instructor and student. Having the course in a form of

programmed learning would be helpful for maintaining student involvement and managing student learning.

Modeling

To be able to model the learning that is expected is important. This modeling can be accomplished through oral examples and pictorial displays that can be transmitted via the computer. This modeling was an integral part of the introductory programming lessons taught in the pilot project. Computer concepts and commands were given in class and demonstrated using the computer. The information the students were to learn was modeled for them. Giving such relevant examples will not be as easy in courses that are not related to the computer or that do not have concrete concepts, but as much as is practical, an attempt should be made to make the concepts as clear as possible. After you have shown the class examples of what you want them to know, it is good to let them try to demonstrate their understanding by doing some activity related to the concepts you have done for the class.

Technical Considerations

There are several adjustments that must be made to effectively teach with computer and audio hook-ups. The presence of an instructor in the classroom taught without the use of telecommunications does not have to deal with hardware, software, or transmission problems. These problems go beyond the effective teaching skills and require an additional skill: operating media.

Typing skill is essential if the instructor is going to use the monitor to display ideas presented in class. The instructor can prepare the class visuals before hand to avoid the problem of having to type needed information on the monitor. Even those instructors who are used to typing may find it difficult to teach and type at the same time. This problem can be overcome by use of a drawing mechanism that is presently available for the existing network, but written or drawn material is less acceptable than typed notes to students viewing a television monitor.

Some familiarity with computers and microphones will be necessary. The pilot project has experienced many technical problems, and if the instructor is not able to address these problems efficiently, then much instructional time will be lost due to transmission problems. The instructor should know how to establish telecommunication links with the remote sites. He should be aware of the limitations of communicating using a microphone and not forget to speak into it so that the remote site can hear what is being said. The students must also use the microphones properly if they

are going to be heard at the other site, as well as at their own site.

The greatest weakness in the initial developmental phase of the ECCTP has been the inability to make and keep contact with the various sites. If the electricity goes off in one site, if a cord becomes disconnected, if the transmission lines are not available, or if the transmissions are not clear, the lesson is halted and learning stops. These problems can be overcome with the establishment of reliable audio and data connections, as has been demonstrated by the computer programming course that is presently being taught between the two campuses of the University of the Virgin Islands.

Post-instruction

After the class has been taught, there are other unique concerns that must be addressed in student evaluation and support. How should evaluation of student's progress be handled and how can the effectiveness of the course be evaluated?

If the preparation and instruction for the class has been well planned, then the evaluation of the students' learning should be easy. The evaluation of the students should be based upon the objectives of the course and the material that was covered in the course. Several formative evaluations are necessary for the instructor to monitor the students' progress. If a programmed learning or a mastery learning approach are used, then evaluation can be based on the students' work. Research suggests that programmed and mastery learning are among the most effective teaching methods. Consideration will have to be given for the supervising of examinations at remote sites and for the moving of examination papers between teacher and students.

Evaluating the effectiveness of the instruction will be especially important in the ECCTP, because it will give some measure by which to compare instruction via telecommunications and traditional or home-site instruction. Little evaluative data was able to be collected during the initial pilot testing of the system. This evaluation was based upon instructors and students' subjective view of the effectiveness of the learning via the computer and audio media. The evaluation of the learning was positive, but there were problems with the transmission of the classes that resulted in long delays or classes being postponed. These problems will need to be corrected if the system is to be a viable teaching tool.

The basic programming course (CSC 101) presently being taught on both campuses of the University of the Virgin Islands using the ECC telecommunications network is an excellent opportunity to evaluate the effectiveness of

distance teaching via computer and audio hook-ups. Comparisons will be made between pre- and post-test results of the students to see if students taught by the same instructor at the home site perform differently from the students at the remote site. Periodic assessment can be made to determine if there is a difference between home site and remote site achievement and attitudes. Also, observations of classroom behavior can be analyzed to get measures of student and instructor learning and teaching differences to see if different teaching approaches result in different behaviors or attitudes from the students. Comparing the material learned with the various teaching variables, i.e. home vs. remote site, high student involvement vs. low student involvement, etc., will give us some data upon which to evaluate the variables related to the project.

Summary and Conclusion

The Eastern Caribbean Center Telecommunications Project (ECCTP) was initiated in the summer of 1985. The goal is to establish a network facility for exchange of instruction among island nations in the Caribbean. The approach selected uses two way audio conferencing for transmitting the voices of the instructor and students, and microcomputers for creating visual images. The network is symmetrical and allows instruction or student response from any node.

The ability of this technology to deliver instruction has been demonstrated. Several improvements and extensions are under development, but the system can be, and is being used in its present form. Regular classes are being delivered over this medium between the St. Thomas and St. Croix campuses of the University of the Virgin Islands (UVI), and trial sessions have been conducted from the Virgin Islands and St. Kitts, and the Virgin Islands and Anguilla.

The potential for an educational telecommunications network in the Caribbean is great. Instructors must be trained to use the technology if the courses are to be effective. The traditional lecture method will not generally be the best method of instruction. The preparation for teaching is more time consuming and more necessary because of the need to present the materials through computer and audio transmissions. The instruction phase of the lesson requires more skill and organization if it is to be effective.

In general, this system for delivery of instruction coupled with use of facilitators at remote sites allows almost all the traditional instructional techniques to be used, though the operation of the medium places an

additional burden on the instructor. Raised student expectations associated with the use of television display and computer technology, coupled with the necessity to give extra attention to motivation and interaction make preparation and planning more important than normal situations. Students will generally be less tolerant of poor teaching when the instructor is remote. The use of these distant learning techniques makes it possible to deliver instruction to remote sites, but makes preparation, planning, attention to student responses, and a variety of other considerations associated with good teaching even more important.